



George C. Marshall Space Flight Center
Marshall Space Flight Center, Alabama 35812

TD15-PLN-013
Baseline
December 13, 1999

Project Plan

for

Space Transfer Technology

In-Space Investment Area

**ADVANCED SPACE TRANSPORTATION
PROGRAM (ASTP)
TD15**

CHECK THE MASTER LIST-VERIFY THAT THIS IS THE CORRECT VERSION BEFORE USE

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SPACE TRANSFER TECHNOLOGY PROJECT PLAN

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SIGNATURE PAGE

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LIST OF ACRONYMS

ARC	Ames Research Center
APRS	Automated Procurement Request System
ASTOR	Advanced Safety Tether Operations & Reliability Satellite
ASTP	Advanced Space Transportation Program
CFM	Cryogenic Fluid Management
CWC	Collaborative Work Commitment
DoD	Department of Defense
GEO	Geosynchronous Earth orbit
GPMC	Governing Program Management Council
GRC	Glenn Research Center
GSE	Ground Support Equipment
HEDS	Human Exploration and Development of Space
IA	Independent Assessment
IFMP	Integrated Financial Management Planning
ISO	Industrial Safety Office
KSC	Kennedy Space Center
JSC	Johnson Space Center
LaRC	Langley Research Center
MARTS	Marshall Resources Tracking System
MSFC	Marshall Space Flight Center
NASA	National Aeronautics and Space Administration
NHB	NASA Handbook
NPD.	NASA Program Directive
NPG	NASA Procedures and Guidelines
NSTAR	NASA Solar Electric Technology Application Readiness
PCA	Program Commitment Agreement
PMC	Project Management Council
POP	Program Operating Plan
ProSEDS	Propulsive Small Expendable Deployer System
SOTV	Solar Orbit Transfer Vehicle
STD	Space Transportation Directorate
STEP	Space Transfer using Electrodynamic Propulsion
VRC	Virtual Research Center
WIS	Workforce Information System

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FOREWORD

This Project Plan describes the planning and objectives for the implementation of a NASA project known as the Space Transfer Technology Project. This plan has been prepared in accordance with the *NASA Program and Project Management Processes and Requirements*, NPG 7120.5A, and is consistent with the *NASA Strategic Management Handbook* and *NASA Program/Project Management*, NPD 7120.4. In addition, it follows the MSFC Lead Center Implementation Plan for Space Transportation System Development and Technology Programs.

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I. INTRODUCTION

The In-Space Investment Area supports the goals of achieving a factor of 10 reduction in the cost of Earth orbital transportation and a factor of 2 or 3 reduction in propulsion system mass and travel time for planetary missions within 15 years. The In-Space Investment area concentrates on space transportation applications within Earth orbit and all the way to interstellar space. The Projects within the In-Space Investment area include: Upperstage Project, Space Transfer Technology Project, and Interstellar Precursor Project. This Project plan is for the Space Transfer Technology Project one element of the In-Space Investment Area. The mission areas for the Space Transfer Technology Project include: Earth orbital destinations, planetary transfer, planetary capture, and descent/ascent systems.

A key goal is the reduction of in-space propulsion system and propellant mass. This would reduce launch costs, by enabling the use of smaller launch vehicles. In addition space transfer costs could be reduced by lowering the propellant mass required for many of these systems. Increased propulsion efficiency would reduce trip times, cutting risk and cost for exploration missions. Spacecraft technology demonstration initiatives like the New Millennium Program have focused on miniaturizing spacecraft and have made substantial breakthroughs; however, in the future, major reductions in total mission/payload size and mass will depend on substantial increases in spacecraft propulsion system efficiencies and lightweight upper stage structures.

More cost-effective upper stages and on-board propulsion systems are critical elements in reducing total space transportation costs. More than 70% of projected launches over the next 10 years will require upper stages to get to their desired location in geosynchronous Earth orbit (GEO) or higher. Current on-board spacecraft propulsion mass fractions range from 30% to 75%; therefore, reducing upper stage propulsion system mass through increased performance and off-board energy sources provides significant leverage to reducing launch costs or increasing payload capability.

The more ambitious science missions planned over the next several decades will require improvements in propulsion technology to remain within their mission cost caps. Future planned missions require 2 to 3 times more total change in velocity over their mission lives than the NASA Solar Electric Technology Application Readiness (NSTAR) demonstration on the Deep Space 1 mission. Rendezvous and return missions will require similar investments in chemical propulsion systems and aerocapture technologies. New opportunities to explore beyond the outer planets and to the stars will require unparalleled technology advancement and innovation.

Space Transfer Technology are also enabling for human exploration, where in-space transportation costs are projected to equal Earth-to-orbit costs. Early investments in these technologies

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will provide for transportation systems to be selected that will provide the safest low cost mission architectures for Human Exploration and Development of Space (HEDS) missions.

II. PURPOSE, SCOPE AND OBJECTIVES

The Space Transfer Technology project has been initiated to support required technologies for meeting the In-Space Investment Area cost goals. It was formulated with the mission of technology development and demonstration that will enable the development of space transfer systems and associated tools that will meet the price and performance goals that are a factor of 10, even 100 less than that currently available.

The project will focus on developing technologies within the following technology areas:

- Tether Transportation Systems
- Electric Propulsion
- Aeroassist Technologies
- Lightweight Components
- Cryogenic Fluid Management
- Advanced Chemical Engines

Within each of these technology areas, there will be multiple sub-tasks identified. The scope of technology development within the Space Transfer Technology Project will include maturing technologies to the point that they can be demonstrated through a flight experiment or demonstrator with the ultimate goal of infusion into the U.S. Industry. Some technologies may not need to be demonstrated in space and can be directly incorporated into an existing vehicle or system.

Several elements within the scope of the Space Transfer Technology Project have matured to the point that they are flight experiments. These include: ProSEDS, STEP, ASTOR, Express, and Microgravity Advanced Upper Stage Gauging Experiment. Individual project plans have been written for these flight experiments (see Appendix A).

III. CUSTOMER DEFINITION AND ADVOCACY

The primary customer for the Space Transfer Technology Project is NASA's Advanced Space Transportation Program (ASTP). ASTP is interested in the development and test of technologies that will potentially provide low-cost space transfer, have low development costs, and that will show near-term results. The Space Transfer Technology customer base

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They include:

- Universities/Academia
- Office of Earth Science
- Office of Space Science
- Office of Life & Microgravity Sciences & Applications
- Office of Aeronautics & Space Transportation Technology
- Office of Human Exploration & Development of Space
- Department of Defense (DoD)
- Industry

IV. PROJECT AUTHORITY

The *NASA Strategic Plan* and the *NASA Strategic Management Handbook* assign to MSFC the Lead Center responsibility for Space Transportation Systems development. This assignment includes Lead Center responsibility for the Advanced Space Transportation Program of which the Space Transfer Technology Project is a part. The Space Transfer Technology Project Office is responsible for project implementation and management. The Space Transfer Technology Project Office has direct commitments with MSFC and other NASA centers through the prime contractors or between the Project Office and NASA Centers. The MSFC Program Management Council (PMC) is responsible for oversight of the Space Transfer Technology Project.

V. MANAGEMENT

A. Organization and Responsibilities

1. NASA Headquarters

The Office of Aero-Space Technology (Code R) is the NASA Headquarters office responsible for the Space Transfer Technology Project.

2. Field Centers

The field centers involved in the Space Transfer Technology Project include: George C. Marshall Space Flight Center, Langley Research Center, Ames Research Center, Glenn Research Center, Kennedy Space Center, and Johnson Space Center. The involvement of each center is described below:

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a. George C. Marshall Space Flight Center (MSFC)

The MSFC, as the lead center for Space Transportation Systems Development and the Center of Excellence for Space Propulsion, is the principal NASA Center for research, technology maturation, design, development, and integration of space transportation and propulsion systems, including both reusable and expendable launch vehicles, and vehicles for orbital transfer and deep space missions.

The Advanced Space Transportation Program, X-33, and Future-X/Pathfinder Program Offices have been consolidated with other space transportation development and technology activities at the MSFC into a new organizational unit, the Space Transportation Directorate. This consolidation enables integrated coordination of ongoing advanced space transportation activities together with strategic planning for new initiatives, and will provide a single focal point for the lead center responsibilities within the mission area of space transportation. The Space Transportation Directorate is responsible for executing the NASA Lead Center role assigned to MSFC for space transportation systems development activities. Integrates program and project level planning, research, and development to ensure a well balanced space transportation development program that meets the Agency's aggregate needs in a coordinated and integrated manner.

Manager, Advanced Space Transportation Program, manages and integrates activities for conducting research and technology maturation and demonstrations applicable to advanced space transportation systems. The ASTP Program Manager serves as principal advisor to the MSFC Assistant Director for Space Propulsion Systems concerning planning, implementation, and evaluation of MSFC's assignment as Propulsion Center of Excellence. The established programs, ASTP, X-33, and Future-X/Pathfinder functionally report to the MSFC Center Director. All program office personnel are being assigned administratively to the Space Transportation Director. The individual program offices are kept small and share administrative staff, program control as well as collocated engineering and procurement support.

Responsibility for the Space Transfer Technology Project falls under the ASTP. MSFC will manage all of the tasks of this project. In addition, MSFC will contribute excellence in the area of Avionics and Flight Control and Systems Integration types of development.

The Space Transfer Technology Project Manager has a small team consisting of members of involved Directorates within MSFC, and representatives from other

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involved centers. This team is responsible for planning, coordinating and interfacing with other projects and organizations as appropriate to accomplish the job.

Program Management (Level II)

Overall Program Management is provided by the Advanced Space Transportation Program Office.

Project Management (Level III)

The Project Manager is assigned by MSFC's ASTP office and reports to the ASTP Program Manager (Level II). The Project Manager is responsible for developing an approach to meet the objectives established by the ASTP Program Manager; developing lower level project constraints such as budget, resources and schedule; and implementation planning that coordinates NASA and contractor assets. The Project Manager will be aided and assisted in all of these activities by a Deputy Project Manager also assigned by the ASTP office.

The products of the Project Manager are:

- **Project Plan.** The Project Plan shall be written in accordance with NPG 7120.5A
- **Resource Allocations** (POP inputs). The Resource Allocations contain estimates of budget requirements and manpower requirements. This report indicates when budgeted funds will be obligated and costed as well as the cost of in-house manpower and its phasing. The Project Manager is assisted by a Business Manager who is assigned by the ASTP management. The Business Manager's primary responsibility is to assure that all procurements are planned and purchased in time to support the project schedule.
- **Collaborative Work Commitments** (CWC). The Project Manager will develop CWCs per MSFC-P03.1-C01. The Project Manager will be assisted by the Deputy Project Manager and Lead Systems Engineer. CWCs are controlled by the Project Manager and held as a quality record in accordance with MSFC-P16.1 for 6 months after completion of the task.

Engineering Management (Level IV)

The Lead Systems Engineer is assigned by the ASTP Program Manager and reports to the Project Manager. The Lead Systems Engineer is responsible to the project for ensuring that all engineering aspects of funded tasks, including in-house, other centers

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and contractor responsibilities are accomplished within the technical requirements and cost and schedule restraints.

The products of the Lead Systems Engineer are:

- CWCs that support project schedule.
- Level IV directives releasing drawings, documentation and change control documentation.
- COTR support and documentation for contracts that support the project tasks.
- Design review agendas, review team coordination, and pre-board disposition.

Task Managers will be assigned for each task funded within the project. Their role will be technical with regard to the nature of the work being conducted in the task.

MSFC also manages a Pathfinder flight experiment, ProSEDS, as well as two other tether experiments, STEP and ASTOR.

b. Langley Research Center (LaRC)

Langley will provide technology development in the area of Aeroassist Technology. They will serve as lead in this technology area.

c. Ames Research Center (ARC)

Ames is supporting technology development in cryogenic fluid management as well as aeroassist technologies.

d. Glenn Research Center (GRC)

Glenn will be responsible for electric propulsion systems. They will serve as the lead for this technology area. In addition, they will provide technology development in the cryogenic fluid management area. GRC manages two of the Pathfinder Flight Experiments: Express and Microgravity Advanced Upper Stage Gauging Experiment.

e. Kennedy Space Center (KSC)

Kennedy supports the cryogenic fluid management area. Also, they will support any flight experiments in the area of Ground Support Equipment (GSE).

f. Johnson Space Center (JSC)

Johnson will participate in the working groups developing technologies in the electric propulsion, aeroassist, and cryogenic fluid management areas.

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B. Special Boards and Committees

Program Leadership Team

An integral element of the Lead Center Program Management Council is the Program Leadership Team. The Program Leadership Team is chaired by the Space Transportation Director and consists of the various Program Managers and appropriate Headquarters and Support Centers personnel.

In addition, the Project Manager shall schedule independent reviews with technical experts not associated with the development activity. These reviews will coincide with the design reviews.

C. Management Support Systems

The following management systems will be utilized with the ProSEDS experiment. In addition, other systems within the agency are being reviewed and considered as potentials.

1. Marshall Resources Tracking System (MARTS)

The MARTS system for tracking funding authority, commitments, obligations, cost and disbursements will be utilized by the Space Transfer Technology Project.

2. Workforce Information System (WIS)

The WIS system will be utilized for tracking the civil service workforce associated with the Space Transfer Technology Project.

3. Automated Procurement Request System (APRS)

The S&E APRS system will be used for the Procurement Requests (Form 424) process.

4. Virtual Research Center (VRC)

The VRC is an Internet-based project management and document management system that allows all project team members access to project documents, drawings, meeting notes, assigned action items and the group calendar.

5. Other Management Systems

Current plans call for the implementation by June 1, 2000 of the Integrated Financial Management Planning (IFMP) system. This is a mandatory, agency wide tool for budgeting, tracking and analyzing funding.

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VI. TECHNICAL SUMMARY

The Space Transfer Technology Project will develop and demonstrate the technologies required to achieve safer, more reliable and affordable space transportation systems. Each of tasks within this project will have project requirements, systems, system operating concepts, ground support systems, facilities, logistics and mission results analysis outlined in individual task project plans. See Appendix A for a listing of currently funded tasks and accompanying Project Plan document numbers.

VII. SCHEDULES

Schedules will be developed and maintained according to NASA procedures and the project plans. Schedules for flight experiments are in the appropriate project plans (see Appendix A). Key Milestones for the Space Transfer Technology Project are as follows:

- 2QFY00 - Deliver 5KW hall thruster propulsion system to a commercial satellite for integration (EXPRESS experiment)
 - Output: Thruster delivered to spacecraft ready for integration
 - Outcome: Allows increased payload capability over chemical systems
- 3QFY00 - Demonstrate a 10kW Hall Thruster in a 500-hr ground test
 - Output: Ground Demonstration of a 10kW thruster operation for 500 hours
 - Outcome: Allows increased payload capability over chemical systems
- 3QFY00 - STEP Preliminary Design Review
 - Output: Preliminary design of flight experiment to demonstrate increased transportation capability of electrodynamic tether systems
 - Outcome: Allows detailed design of the flight experiment to be conducted. Ultimate demonstration is for a propellantless low-cost orbit transfer system using electrodynamic tether.
- 4QFY00 - Demonstrate electrodynamic tether propulsion (ProSEDS)
 - Output: In-flight Demonstration of altitude lowering of a Delta II 2nd stage
 - Outcome: Provides demonstration of low-cost system to remove spent stages and satellites from orbit, without using onboard propulsion system.
- TBD, based on SOTV launch - Demonstrate capability to precisely measure cryogenic propellant levels in zero-g
 - Output: In-flight demonstration of mass gauging capability

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Outcome: Allows accurate measurement of propellants on orbit, resulting in lowering propellant loading for uncertainty. Ultimate outcome is reduced mass chemical systems

VIII. RESOURCES

Funding for the Space Transfer Technology Project covers all effort, materials and services. In addition funding is shown for the Pathfinder Experiments that are included in the Space Transfer Technology Project area. The project funding plan by fiscal year is shown below:

A. Funding Requirements (NOA in Millions)

	<u>FY00</u>	<u>FY01</u>	<u>FY02</u>	<u>FY03</u>
Space Transfer Technology Projects	4.9	7.2	14.4	14.4
Pathfinder Experiments	4.8	1.4	0.3	-
TOTAL	9.7	8.6	14.7	14.4

IX. CONTROLS

The Space Transfer Technology Project is subject to the controls as contained in NASA Procedures and Guidelines, NPG 7120.5A, effective April 3, 1998. The Space Transfer Technology Project Plan establishes the top level technical, schedule, and cost controls placed on the project. A semi-annual review of this plan will be performed to accommodate the changing nature of advanced technology projects. All revisions to the Project Plan will be coordinated with the Manager of the Advanced Space Transportation Program. Responsibilities for Program and Project Management are as follows:

A. Headquarters Responsibilities

Associate Administrator for Aeronautics and Space Transportation Technology

- Providing program advocacy.
- Establishing program requirements and metrics.
- Recommending the level of GPMC oversight for each new program.
- Assigning program and selected project responsibilities to Lead Centers.

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- e. Recommending new programs to the Agency PMC.
- f. Developing, coordinating, and maintaining the PCA.
- g. Approving Program Plans.
- h. Assessing program performance against requirements and customer expectations.
- i. Ensuring timely resolution of multiple program and project issues with assigned enterprise.
- j. Serving as a member of the GPMC.
- k. Allocating budgets to programs.

B. Center Responsibilities

1. Lead Center Director (MSFC)

- a. Serving as Chairperson of Lead Center PMC.
- b. Supporting the Associate Administrator of Aeronautics and Space Transportation Technology in program formulation.
- c. Providing overall direction, control, and oversight of program implementation.
- d. Appointing the program manager.
- e. Concurring on the Program Plan for Associate Administrator approval.
- f. Assigning work to other Centers.
- g. Integrating institutional resources with program needs.
- h. Coordinating cross-Center activities.
- i. Ensuring compliance to policy/standards.
- j. Maintaining dual path for Quality and IA.
- k. Developing and maintaining program/project implementation policies and procedures compliant with NPD 7120.4, NPG 7120.5A, and ISO 9000.

2. Performing Center Director (MSFC)

- a. Performing advanced concept studies in support of Agency and enterprise strategic plans.
- b. Supporting the program formulation.
- c. Approving Project Plan.
- d. Appointing the Project Manager.
- e. Project implementation and oversight.
- f. Developing and maintaining program/project implementation policies and procedures compliant with NPD 7120.4, NPG 7120.5A, and ISO 9000.

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3. ASTP Program Manager

- a. Program planning, including: recommendation of program objectives, requirements, implementation guidelines, program integration, budget and milestones, and preparation of Program Plans and PCA's.
- b. Developing, recommending, and advocating the program resources.
- c. Execution of the Program Plan and oversight.
- d. Approving Project Plans and associated changes to these documents.
- e. Reviewing and reporting program/project performance.
- f. Establishment of project requirements and performance metrics.
- g. Allocating budget to projects.
- h. Control of program changes.
- i. Establishing support agreements.

4. Space Transfer Technology Project Manager

- a. Preparation and maintenance of the Project Plan, specifications, schedules, and budgets.
- b. Acquisition and utilization of participating contractors.
- c. Execution of the Project Plan.
- d. Reporting project status.
- e. Approving Task Agreements.
- f. Conducting design and all other appropriate reviews.
- g. Participation in Configuration Control Board Activity.

X. IMPLEMENTATION APPROACH

The Space Transfer Technology Project is intent on developing technologies that reduce risk and cost associated with in-space systems. Technologies will be assessed based on their application to goals for the In-Space Investment Area. Prioritization activities will be conducted to assess the technology needs. In addition, Inter-Center Working Groups will be established to define the roadmaps and contents of specific technology areas. Three Inter-Center Working Groups have already been established in the following technology areas: Cryogenic Fluid Management (CFM), Aeroassist Technologies, and Electric Propulsion. Other working groups will be established for other technology areas as funding and requirements warrant.

XI. ACQUISITION SUMMARY

The Space Transfer Technology Project acquisition strategy is based on both NASA in-house and contracted activities. All of the planned individual contracts are currently anticipated to be less than

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\$10M. Because of the experimental nature of the Space Transfer Technology Project and tight time schedules, every emphasis will be placed on short procurement approaches. Existing contracts, NASA Research Announcements, Purchase Orders, and Support Agreements will be utilized to the greatest extent possible.

XII. PROGRAM/PROJECT DEPENDENCIES

The Space Transfer Technology Project will maintain cognizance of the Cross Enterprise Technology Development Program (Code S) for technology areas applicable to in-space transportation systems. In addition, continual inputs from Programs with in-space requirements will be solicited and these inputs will be factored in to the prioritization of the technology investments in the In-Space area.

XIII. AGREEMENTS

A. Internal NASA Agreements

MSFC has been assigned as the Lead Center for the Space Transfer Technology Project and is responsible for project implementation and management. The Space Transfer Technology Project will require significant coordination between MSFC and the other participating centers. Coordination on specific technology development activities will be dictated by circumstances on an "as-needed" basis.

B. External Agreements

The Space Transfer Technology Project is expected to have external agreements through Contractors and other agencies. All external agreements will be determined by competition as part of the overall acquisition strategy.

C. NASA/DoD Agreements

NASA has been assigned the Lead Agency for the development of Reusable Space Transportation systems, most of which have applicability for future DoD technology requirements. NASA and the Air Force have signed a Memorandum of Agreement calling for cooperative technology development and demonstration in support of NASA's Advanced Space Transportation Program and the military Space Operations Vehicle. The Air Force has submitted a letter showing support for the SpaceLiner 100 class RLV and their intent to procure launches.

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XIV. PERFORMANCE ASSURANCE

Quality

For flight experiments in the Space Transfer Technology Project, Quality Plans will be developed. Flight hardware designed, developed and built in-house at MSFC will be in accordance with the MPG 144.1. Space Transfer Technology Project flight hardware designed, developed, and built in-house at other Centers will be in accordance with the relevant Center policies and procedures.

Due to the limited scope of the Space Transfer Technology Project flight demonstration experiments, flight hardware may be commercial off-the-shelf (COTS) as long as it meets the requirements specified in the governing specification documents.

Space Transfer Technology Project flight hardware purchased from outside vendors may not be required to be ISO 9000 compliant. Space Transfer Technology Project flight hardware purchased from outside vendors will be based on the specific requirements of NHB 5300.4(1C). Tailoring of these requirements will be reflected in appropriate flight project Quality Plans and/or in the vendor purchase order/contract.

XV. RISK MANAGEMENT

Flight experiments in the Space Transfer Technology Project will develop an approach to risk management. This will either be documented in the Project Plan or a separate Risk Management plan will be developed to document a continuous process that:

- identifies risks
- analyzes their impact and prioritizes them
- develops and carries out plans for risk mitigation, acceptance, or other action
- tracks risks and the implementation of mitigation plans
- supports informed, timely, and effective decisions to control risks and mitigation plans
- assures that risk information is communicated among all levels of the project

Risk management begins in the formulation phase with an initial risk identification and development of a Risk Management Plan and continues throughout the product's life cycle through the disposition and tracking of existing and new risks.

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XVI. ENVIRONMENTAL IMPACT

Environmental impact assessment(s) shall be developed as needed by the appropriate center(s) Environmental Engineering and Management Office(s).

XVII. SAFETY

The Space Transfer Technology Project will utilize existing Center safety guidelines to provide for the early identification, analysis, reduction, and/or elimination of hazards that might cause the following:

- Loss of life or injury/illness to personnel
- Damage to or loss of equipment or property (including software)
- Unexpected or collateral damage as a result of tests
- Failure of mission
- Loss of system availability
- Damage to the environment

As required for specific tasks in the Space Transfer Technology Project a safety plan that details such activities as system safety, reliability engineering, electronic and mechanical parts reliability, quality assurance for both hardware and software, surveillance of the development processes, “closed loop” problem failure reporting and resolution, environmental design and test requirements will be developed. Mission success criteria shall be defined to aid in early assessment of the impact of risk management trade-off decisions. The safety and mission success activity shall accomplish the following:

- Provide for formal assessment and documentation of each hazard, with risks identified, analyzed, planned, tracked, and controlled.
- Provide for a safety assessment and certification regarding readiness for flight or operations, explicitly noting any exceptions arising from safety issues and concerns.
- Utilize a quality management system governed by the ISO 9000 standard, appropriate surveillance, and NASA Engineering and Quality Audit techniques.

XVIII. TECHNOLOGY ASSESSMENT

Ongoing assessment of needs for technology will be conducted by project management to insure that long term goals can be met.

XIX. COMMERCIALIZATION

Many of the technologies to be demonstrated have direct commercial application.

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XX. REVIEWS

A. Management Reviews

Management Reviews will be scheduled during the life of the project. The type and frequency of the reviews will be established according to the unique needs of the Project and the Program Office . The reviews will be scheduled to keep program and project management informed of the current status of existing or potential problem areas. Agency management will be informed, in advance, of the schedule and agenda of the major reviews and will be invited to participate at their discretion. Special reviews by any level of management will be conducted when the need arises.

1. Lead Center Program Management Council (PMC) Review

As a project in the Advanced Space Transportation Program, the Space Transfer Technology Project will be reviewed during the lead Center Program Management Council Review of the ASTP program. The reviews will cover overall status information, including schedule, change, performance, funding, interface coordination, and other management and technical topics. The Lead Center PMC review will also assess project progress against metrics and criteria proposed in procurement instruments.

2. Quarterly Program Review

A quarterly program review will be held to review cost, schedule, and technical issues. The location of the review will be determined on a case-by-case basis. Participants will include, as a minimum, the program managers of the ASTP and STD offices.

3. Other Reviews

Other independent reviews will be scheduled as required.

B. Technical Reviews

Each technology development effort will be reviewed at six-month increments to assess progress. Decisions for continuation, redirection, and/or cancellation will be made at that time.

XXI. TAILORING

The requirements of NASA Policy Directive (NPD) 7120.4A and NASA Procedures and Guidelines (NPG) 7120.5A apply to this program as tailored by the ASTP Program Plan.

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APPENDIX A PROJECT PLANS FOR FLIGHT EXPERIMENTS

FLIGHT EXPERIMENT	PROJECT PLAN
Propulsive Small Expendable Deployer System (ProSEDS)	ASTP-PLN-0002
Advanced Safety Tether Operations & Reliability Satellite (ASTOR)	ASTP-PLN-0005
Space Transfer using Electrodynamic Propulsion (STEP)	ASTP-PLN-0010
EXPRESS Hall Thruster Flight Experiment (EXPRESS)	GRC Document
Microgravity Advanced Upper Stage Gauging Experiment	GRC Document